

AN INEXPENSIVE VACUUM COLLECTOR FOR INSECT SAMPLING¹

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ABSTRACT: An inexpensive suction sampler was constructed by modifying a gasoline powered leaf blower/vacuum (Weed Eater®). Comparison of the sampler with use of an aquatic dip net to collect a planthopper species from emergent aquatic plants showed that the sampler was more efficient in collecting adults and was especially useful for capturing early instars. The Weed Eater® sampler was comparable or superior to a D-Vac for collecting grassland arthropods (Wright and Stewart 1992). The total cost of this light (<6 kg.) sampler, including modifications, is ca. \$130.

The commonly used methods of collecting or sampling insects by sweeping, beating, aspirating, or hand-picking undercollect very small insects and mites disproportionately and miss arthropods at the base of low vegetation (Herms *et al.*, 1990; Perfect and Cook, 1983; Schotzko and O'Keefe, 1989; Southwood, 1978; Summers *et al.*, 1984). Suction collectors such as the D-Vac (Dietrick, 1961) overcome these inadequacies at the costs of large size and weight (18.1 kg), expense (US\$1100+), portability, and reliability. In this paper we describe a relatively small (5.7 kg), inexpensive (\$130) and portable vacuum collector (hereafter referred to as the "bug-vac") easily converted from a gasoline-powered leaf blower.

MATERIALS AND METHODS

Modifications were made to a Weed Eater® hand held leaf blower (Model 1920, 920, or 960) and Weed Eater® vacuum attachment kit (Model 952-701613 (VA 1905)) purchased at a discount store (the manufacturer's address is: Poulan/Weed Eater, Division White Consolidated Industries, Inc., Shreveport, Louisiana 71139-9329, USA). Materials for modification include duct tape (heavy duty cloth tape), eight 1.2 cm x 0.3 cm machine screws, eight lock washers and nuts, one piece of 0.95 cm metal circular screen, and two U-clamps (to attach the strap to the body of the leaf blower). Detailed instructions for assembly and use as a leaf vacuum are supplied by the manufacturer with the vacuum attachment kit; modifications to these instructions include the following:

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- 1) The strap on the vacuum bag (part of the vacuum attachment kit) was cut off where it connects to the bag, the bag disposed of (the machine can be operated with the vacuum bag attached), and a clamp sewn onto each end of the strap. The clamps on the strap were attached to the ring on the leaf blower handle.
- 2) The basal end of the vacuum tube (from the vacuum attachment kit) was fastened to its fitting sleeve by four bolts and nuts rather than just by the large, circular hose clamp supplied for this purpose. Four holes were drilled through the plastic sleeve on the machine, the base of the plastic vacuum tube, and the hose clamp. The exposed ends of the bolts were wrapped with duct tape around the outside of the vacuum tube ("a" in Fig. 1).
- 3) We used two methods to prevent the insect-collecting bag from being accidentally sucked into the vacuum fan. Either (1) a flat circular piece of wire screen (0.95 cm mesh) can be bolted into the interior of the vacuum tube about 30 cm from the distal end of the tube or (2) the screen can be fashioned into a cup-shaped basket that fits snugly within the tube with the rim of the basket bent flush and taped along the outside 2 cm of the vacuum tube. Loose ends of wire in the screen are soldered. In either method, any protruding bolts or the wire rim of the basket are tightly wrapped with heavy tape to cover these sharp protrusions ("b" in Fig. 1).

Orienting the leaf blower in a reverse (or backward) position facilitates starting.

RESULTS AND DISCUSSION

The bug vac proved equal or superior to sampling with a D-Vac or net. Wright and Stewart (1992) converted an Atco "Blow-Vac" leaf-blower using our directions and compared its sampling efficiency to a D-Vac in three grassland sites in Great Britain. They found that the "Blow-Vac" collected comparable numbers of Diptera, Hymenoptera, and most Homoptera (Auchenorrhyncha). The D-Vac caught significantly greater numbers of two species of leafhoppers (Cicadellidae) at one of the three sites. However, their "Blow-Vac" proved much more efficient than the D-Vac for capturing Coleoptera and Araneae.

The improved collection of immature planthoppers such as the delphacid *Pissonotus piceus* (Van Duzee) (Homoptera: Fulgoroidea) using the bug-vac was demonstrated in collections from its host, the emergent aquatic plant "mild water pepper" (*Polygonum hydropiperoides* Michx.) Sweeping this plant proved to be an inadequate method of collecting this delphacid. A more efficient method, used once per week

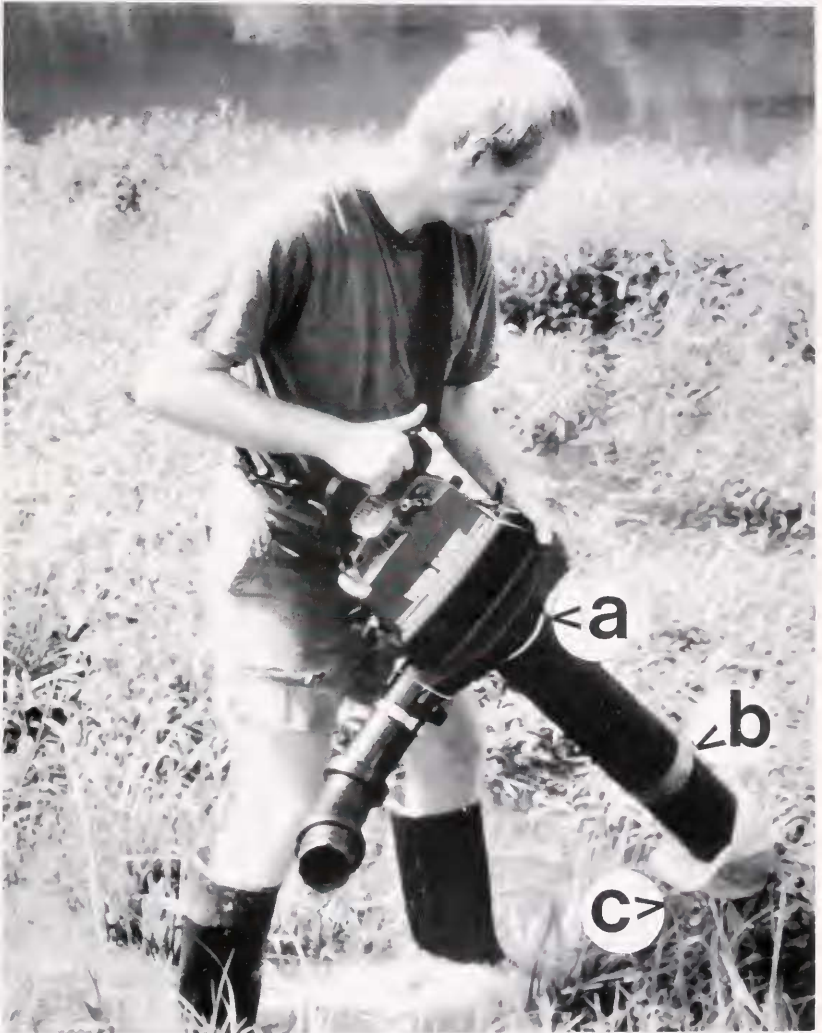


Fig. 1. Using the gasoline-powered leaf blower adapted as an insect vacuum ("bug-vac") to collect insects from an aquatic emergent plant. Four bolts attach the basal end of the vacuum tube to a sleeve on the machine; exposed ends of the bolts are covered with cloth tape (a). A wire screen is bolted to the inside of the collector tube; exposed ends of the bolts are covered with cloth tape (b). A net bag is inserted in the vacuum tube and attached with two large rubber bands (c).

during 1989, was to strike the plants with an aquatic dip net and aspirate the insects from the net. During 1990, the bug-vac was used to sample insects from plants as the collector waded through the vegetation (Fig. 1). The bug-vac reduced average sampling times from 45 to 5 minutes and collected a greater mean number of planthoppers (Fig. 2; $t = 2.87$, $p < 0.05$). It was especially useful for collecting the small (length ca 1.0 mm.) first instar nymphs (Fig. 3; $t = 3.15$; $p < 0.05$), few of which were damaged.

As with other vacuum collectors, the bug-vac develops higher intake velocities with the collecting tube near the ground. Despite this, we collected significantly higher numbers of the leafhopper *Fieberiella florii* Stål (Homoptera: Cicadellidae) from its typical shrub or hedge host plants in Berkeley, California with the bug-vac, than with a standard

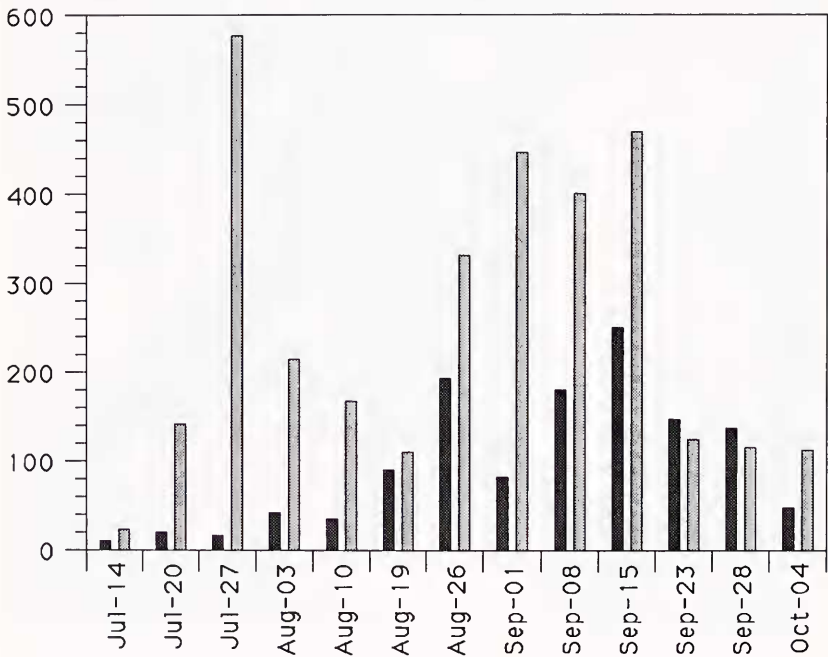


Fig. 2. Number of *Pissonotus piceus* collected per week with a dip net (dark stippling) and bug-vac (light stippling); $N_{\text{dip net}} = 1587$, $N_{\text{bug vac}} = 3732$.

sweep net (Purcell, unpubl. data). In these sampling experiments, equal-length halves of boxwood (*Buxus* sp.) or privet (*Ligustrum* sp.) hedges were sampled by thoroughly sweeping or vacuuming horizontally with the net or bug-vac. Typical of other suction collectors, the bug-vac was more efficient than sweeping, especially in collecting early instar nymphs of *F. florii*.

The light weight and size of the bug-vac allow it to be transported, disassembled, in a large suitcase if the exhaust tube and terminal end of the vacuum tube are removed. Also, it can be carried in a carton that fits easily in the luggage compartment of small automobiles. One disadvantage shared with the D-Vac is the high noise level of the bug-vac; ear protection should be worn during operation. The engine has proven to be reliable and durable over four seasons of use.

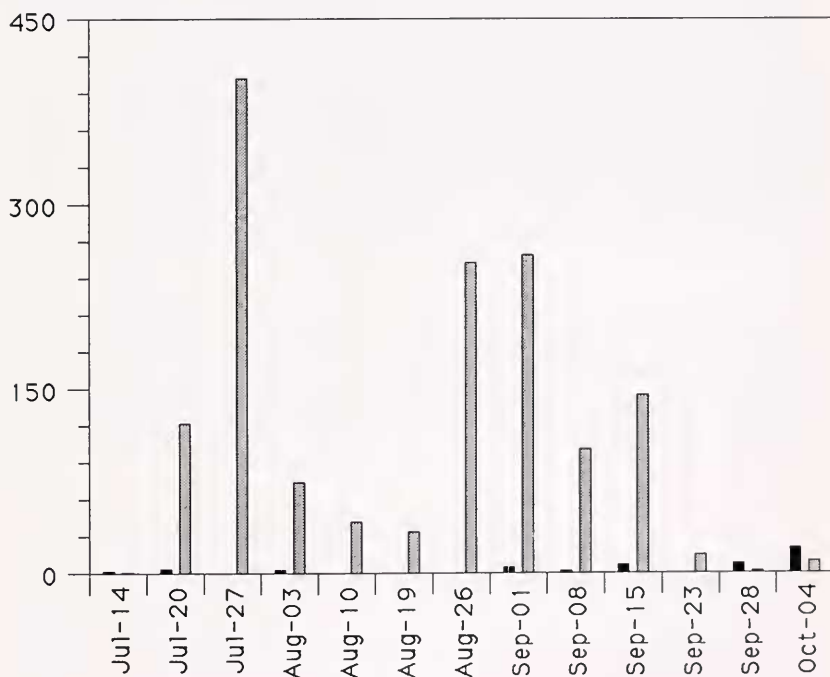


Fig. 3. Number of *Pissonotus piceus* first instars collected per week with a dip net (dark stippling) and bug-vac (light stippling): $N_{\text{dip net}} = 92$, $N_{\text{bug vac}} = 754$.

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